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Pilot Testing an Intervention to Promote Healthy Eating Among Puerto Rican Adolescents: Lessons Learned on Dietary Fiber Consumption

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Abstract

Background: Data reported in the Youth Risk Behavior Surveillance System (YRBSS) showed that 24.2% of Puerto Rican adolescents (grades 9th through 12th) were overweight or obese, 14.3% did not eat fruit, and 16.4% did not eat vegetables "during the 7 days before the survey". The need for culturally-sensitive-age-appropriate nutrition education materials in Spanish is imperative for the success of obesity prevention initiatives.

Objective: To promote changes in dietary behaviors, among 12 to 14 years old adolescents, through the development of culturally sensitive and age-appropriate nutrition education materials for an educational intervention on healthy eating.

Design: A pretest and two post-tests design was employed to measure changes in dietary behaviors, with a Post-test II after one month to evaluate if changes were maintained.

Participants/Setting: Participants were 339 adolescents aged 12-14 years. Interventions, conducted by trained Extension educators, took place in 10 Extension's 4-H clubs, including rural and urban settings.

Intervention: The intervention consisted of the implementation of the six lessons curriculum moving to Healthy Eating. Every lesson was taught face-to-face on a period of 45 to 60 minutes followed by experiential learning activities on the topics.

Main outcome measures: Changes in the frequency of consumption of vegetables, fruits, 100% fruit juices, whole-grain rice and cereals, low-fat milk, fried foods, sweet desserts, water and sugared beverages.

Statistical analysis performed: Data was analyzed through Analysis of Variance ANOVA using a Linear Mixed Model ($P<0.05$).

Results: Pre vs. post-I comparisons showed a significant increase in the frequency of consumption of vegetables and a decrease in consumption of sweet desserts. After one month (post-II), participants showed a significant increase in the frequency of consumption of dietary fiber consumption on fruits, vegetables, fruits, whole grain rice, cereals and 100% fruit juices while decreased their consumption of sweet desserts, compared to pre-test.

Conclusion: Tailored culturally sensitive nutrition intervention promotes positive healthy eating in Puerto Rican adolescents by increasing dietary fiber consumption of fruits, vegetables and whole grain-cereals.

Keywords: Adolescents; Nutrition; Hispanic nutrition; Nutrition education; Dietary fiber; Culturally sensitive; Spanish curriculum

Introduction

Data reported in the Youth Risk Behavior Surveillance System (YRBSS) [1] showed that 24.2% of Puerto Rican adolescents were overweight or obese, 14.3% did not eat fruit, and 16.4% did not eat vegetables. Moreover, 30% did not participate in at least 60 minutes of daily physical activity. Studies have shown that being overweight or obese between ages 14 to 19 is associated with increased adult mortality from a wide variety of systemic diseases [2,3].

Puerto Rico Agricultural Extension Service (PRAES) address the prevention of childhood obesity as one of its main critical issues. Efforts for obesity prevention have been done; however, obesity is still a public health problem. Most of the educational tools available for obesity prevention are in English, which is not the primary language in Puerto Rico. The need for culturally-sensitive-age-appropriate nutrition education materials in Spanish is imperative for the success of obesity prevention initiatives [4,5].

The long-term goal for this study was to prevent and reduce the prevalence of obesity in Puerto Rican adolescents. The specific objective is to promote changes in dietary behaviors, among 12 to 14 years old adolescents, through the development of culturally sensitive

and age-appropriate nutrition education materials. Muévete a la Sana Alimentación (Moving to Healthy Eating) Curriculum was developed to fill the need of these nutrition educations materials. A pilot study was conducted to evaluate its effectiveness through changes in dietary behaviors via the implementation and evaluation of this curriculum presented to adolescents participating in Extensions' 4-H Club. The initial phase of this pilot study identified the barriers to healthy eating through a series of eight focus groups (five with the targeted age group, two with their parents and caregivers and one with Extension educators) as described elsewhere [6]. The data obtained from the pilot study, was used to design Spanish educational materials that address the specific needs of the target youth audience.

The final educational materials included the participants' opinions in the creation of a nutrition education curriculum with experiential learning activities (videos, recipe books and age-appropriate written materials. These materials were developed to be culturally sensitive, considering local foods and traditional dishes and addressing the socio-economic environment that influences the food choices of the target group, including accessibility, taste and cost. These materials intended to increase the consumption of high fiber foods, such as fresh fruits, vegetable and whole grains; through variety of simple, low-cost, delicious and nutritious recipes that are age and culturally adapted. This pilot study provided the educational tools to prevent and reduce the prevalence of obesity in Puerto Rican adolescents.

Materials and Methods

This study took place in ten in-schools' 4-H clubs. These schools belong to the public school system of the Department of Education in Puerto Rico. PRAES 4-H Club and Youth Development Program focuses in providing educational opportunities to underserved youngsters between the ages of 8 to 18 years old on the island. While Puerto Rico, in general, experiences a high level of children living in poverty (64.3%), the selected communities resulted to be amongst the poorest in the island with a children living under poverty rates ranging from 75% to 83% [7].

Participants in the intervention were 4-H members from 10 Extension 4-H clubs, aged 12 to 14 years old. Two clubs were selected from each of the five regions of PRAES. Selection criteria for the 4-H clubs were based on that Extension's Family and Consumers Sciences (FCS) professionals with a higher time assignment to 4-H programmatic area in order that these personnel could dedicate the necessary time for the project. One of the two clubs from each PRAES region was selected from an urban area and the other from rural area. Puerto Rico is a densely populated country (17th in the world with 414 persons per square kilometer) [8]. For this study, the research group followed USDA "non-metro" area definition to design the rural areas [9]. This classification will define accurately, the rural areas in Puerto Rico, since social isolation and less developed land are better indicators of rurality in Puerto Rico. 4-H Clubs selected represented coastal, interior and mountainous areas in Puerto Rico. Members from each club must be in the 12 to 14 years old range and should not have had any nutrition course at the time of the study.

Intervention

The intervention consisted of the implementation of the six lessons curriculum Moving to Healthy Eating. Every lesson was taught face-to-face on a period of 45 to 60 minutes on the following topics: the importance of healthy eating, barriers to healthy eating, the use of MyPlate, and strategies to increase consumption of fruits and vegetables, whole grain cereals, healthy snacks and physical activity, followed by experiential learning activities on these topics. Each lesson was offered once a week.

Lessons and activity plans

The six lessons addressed the areas of intervention according to participants needs: barriers to healthy eating, to increase the consumption of dietary fiber through fruits, vegetables and whole grain foods, selection of healthy snacks and importance of physical activities. The lesson plan is described in Table 1. During the first lesson of the curriculum, the young participants discussed barriers to healthy eating they confronted at home, in schools and eating away from home, and identified strategies to overcome those barriers.

A supplemental activity guide was created to include the hands-on activities to enrich the main curricular guide. Most experiential learning activities promoted the development of cooking skills and the opportunity to try new foods or combination of culturally accepted foods with the integration of fruits and vegetables. The young participants also practiced developing healthy meals based on the recommendations from USDA My Plate. Following the second lesson of the curriculum, participants created at least two short educational videos from what they have learned in the lessons, which included the demonstration of a healthy recipe, among other activities.

Variables	Lesson topic	Experiential learning activities	Duration
Week 1	Barriers to healthy eating	Video preparation on how to overcome healthy eating barriers	30-60 minutes
Week 2	Guides to Healthy Eating: My Plate	Relay for My plate Game	30-60 minutes
Week 3	How to increase fruits and vegetables consumption?	Recipe demonstration and preparation using local fruits and vegetables	30-60 minutes
Week 4	Strategies to increase whole grain cereals	Recipe demonstration and preparation	30-60 minutes
Week 5	How to prepare healthy snacks	Recipe preparation	30-60 minutes
Week 6	Increasing physical activity and hydration	Games and dances, Calculate water needs	30-60 minutes

Table 1: Muévete a la Sana Alimentación (Moving to Healthy Eating) curriculum used in the pilot testing of an intervention to promote healthy eating among Puerto Rican adolescents.

Participants wrote their own scripts and recorded the videos on Tablets provided by the project, with the assistance of PRAES' FCS trained Professionals and using the video preparation guide developed by a filmmaker with expertise on short videos and documentaries. This experiential-learning activity served to reinforce knowledge gained and promote behavior change. Videos were shared with friends, families and some were presented in special school activities (health fairs and accomplishment recognition days).

The new curriculum developed was delivered by PRAES FCS professionals trained by PRAES Nutrition Specialist, following a train-the-trainer approach. PRAES CFS professionals participated of a one-day workshop on the new nutrition materials, its educational methodology and the evaluation process, offered by PRAES Evaluation and Nutrition Specialists (PI and CoPI of the project). PRAES FCS professionals participated in ongoing trainings that updated their nutrition knowledge and concepts, therefore this training emphasized on the socio-economic environment that surrounds the target group and influences their food selection process. This knowledge gained during the first objective of the project was the generation of new knowledge on socio-economic, cultural and environmental barriers to healthy eating and physical activity through applied research. A second one-day workshop focused on the creation of short educational videos offered by the filmmaker who developed the educational guide. PRAES FCS professionals on the pilot study received Tablets, tripods, microphones and other necessary tools for this purpose.

Data collection and analysis

A pretest and two post-tests design was employed to determine changes in the following dietary behaviors: 1) increase in consumption of vegetables, fruits, 100% fruit juices, whole-grain rice and cereals, water and low-fat milk and 2) decrease in consumption of fried foods (Puerto Rican-type fritters empanadillas, alcapurrias, rellenos and others), sweet desserts (donuts, cakes, cookies and other candies) and sugared beverages (sodas, maltas or juice beverages). The adolescents' participants answered a second post-test, one month after completing the intervention. Items measured frequency of consumption with a Likert-type 5-point scale (5=everyday; 4=almost every day; 3=sometimes; 2=almost never; 1=never). Questionnaire was evaluated for content validity and face validity. Content validity analysis was performed by a committee of experts including the authors (PI and Co-PI) both with expertise in nutrition and developers of the curriculum content. Face validity was determined through a pilot-testing of the questionnaire for clarity and understanding with a group of 4-H club's members (N=15) of similar ages (12-14 years old), that did not participated in the intervention.

Data was analyzed through Analysis of Variance ANOVA using a Linear Mixed Model. The fixed factor was time and random factors were ID and 4-H clubs. Results were considered statistically significant at $P<0.05$. Means comparisons were done in three times using a Least Significant Difference (LSD) test. Statistical analyses were performed with SPSS software [10]. The study was approved by the University of Puerto Rico at Mayagüez Institutional Review Board with an exempt approval under federal regulation 45 46.101 (b) CFR [11]. Written consent was provided by parents/guardians to participate in educational activities when initiating in 4-H. Written assents was obtained from the young participants before the study.

Results

A total of 339 adolescents participated in the intervention and answered the pretest. All participants were between the ages of 12 to 14 years old, 64% were from urban areas and 36% from rural settings; 47% were female, 49% male and 4% did not answered. Comparisons of reported frequency of consumption between pretest and post-I (end of the intervention) showed significant changes in two dietary behaviors including increase in the frequency of consumption for vegetables 2.57 vs. 2.69.

Food Groups	Pretest (SD)	Post-II (SD)	Mean Change (SD)	P Value
Vegetables	2.57 (1.0)	2.69 (1.1)	0.15 (1.0)	0.01
Fruits	3.58 (1.0)	3.71 (0.9)	0.13 (0.9)	0.04
Whole wheat rice	2.39 (1.3)	2.57 (1.3)	0.24 (1.2)	0.001
Whole wheat cereals	2.61 (1.2)	2.78 (1.2)	0.19 (1.4)	0.03
Fruit juices (100%)	2.79(1.4)	3.46 (0.9)	0.14 (1.1)	0.04
Low-fat milk	3.79 (1.2)	3.67 (1.1)	-0.14 (1.0)	0.07
Water	4.69 (0.7)	4.65 (0.7)	-0.03 (0.8)	0.5
Sugared beverages	3.54 (1.2)	3.43 (1.0)	-0.12 (1.0)	0.06
Sweet desserts	3.34 (1.2)	3.21 (0.9)	-0.13 (1.0)	0.04
Fried foods	3.20 (1.1)	3.13 (0.9)	-0.09 (1.0)	0.1

Table 2: Mean frequency of consumption and standard deviation (SD) of food groups for pretest and post-II data (after one month) of an intervention to promote healthy eating among Puerto Rican adolescents.

A significant change was also observed in the decrease of sweet desserts 3.34 vs. 3.21. Table 2 shows mean frequency of consumption and standard deviation for the Pretest and Post-II (one month after intervention) data. Results showed mean frequency of consumption for vegetables significantly increased at Post-II, suggesting increases in Post-I continued and was maintained at Post-II, one month after the intervention. Mean frequency of consumption for fruits also showed a significant increase at Post-II. Other dietary behavior changes were observed after one month of the intervention. Data showed significant increases in whole-wheat rice, whole-wheat cereals and 100% fruit juices. There were no significant changes in these food groups between the pretest and the post-I (end of intervention) which might indicate that changes in these dietary behaviors could have taken longer to be adopted. Analysis of the non-healthy foods (fried foods, sweet desserts and sugared beverages) showed a significant decrease only for sweet desserts (donuts, cakes, cookies and other candies) at Post-II, compared with the pretest. No significant dietary behavior changes were observed for low fat milk, fried foods, sugared beverages and water. Water consumption was high and maintained throughout the study.

Discussion

Moving to healthy eating, a Spanish curriculum targeting Puerto Rican adolescents, promoted positive behavior changes that are important for the prevention of childhood obesity. A significant

increase in the frequency of consumption of fruits and vegetables at Post-II suggests that these changes continued and were sustained one month after the end of the intervention. According to the YRBSS more than 14% of Puerto Rican adolescents did not eat fruit or vegetables [1]. One of the three recipe booklets in the Moving to Healthy Eating curriculum is specifically focused on easy and low-cost recipes of frappes and shakes based on fruits and vegetables. As part of the experiential-learning activities the young participants had the opportunity to prepare these recipes and taste new foods or new combinations of fruits and vegetables. Findings from a systematic review suggests that cooking interventions may have positive influences on children's dietary behaviors, improving FV consumption or preference in school-aged children, 5 to 12 years old [12]. In addition, curriculum-based approaches taught among primary school-aged children, found statistically significant improvements in fruits and vegetables consumption particularly those combined with secondary approaches such as experiential learning activities [13].

Rice is a staple food in the Puerto Rican culture, being consumed as white processed rice. In recent years, under First Lady Michelle Obama's Let's Move and Healthy School Lunch Program, the school lunch program in Puerto Rico started the introduction of whole-wheat rice. Acceptance of this new food item has been low and students have indicated lack of taste, unpleasant texture and not culturally familiar to the product, as major barriers in the acceptance of whole wheat rice [6]. A second recipe booklet was developed as part of the curriculum to address barriers to healthy eating by providing recipes that incorporated whole-wheat rice to substitute traditional white rice recipes and the inclusion of new recipes adding a variety of vegetables. Results of this pilot study showed significant increases in consumption of whole-wheat rice and cereals even after a one month following the intervention.

One of the major barriers to healthy eating among Puerto Rican adolescents in the school environment was the near school's stores (tienditas) [6]. These stores sell a variety of unhealthy food choices that are high in sodium, sugar and fat, and are largely accessible to students, therefore competing with the school lunch program. Foods available in these stores include sugared beverages, fried foods and sweet desserts. During the first lesson of the curriculum, the young participants discussed the influences of unhealthful food choices at las tienditas and through experiential learning activities defined strategies to overcome such barrier. Results showed only a significant decrease in sweet desserts while no significant changes in sugared beverages and fried foods.

The Center for Disease Control and Prevention reported significant racial and age disparities among these groups, finding a higher incidence of childhood obesity in Hispanics (25.8%) compared to any other racial groups [14]. Barriers to healthy eating among this Puerto Rican group emphasized on home and school environments [6]. A systematic review of nutrition education programs on adolescents indicated that multi-strategy interventions can have significant dietary changes. This includes the integration of parents, families and schools [15].

Extension FCS professionals are in a strategic position to promote these multi-strategy interventions focusing on the prevention of childhood obesity. On most occasions, Extension FCS professionals target both, youth and adult audiences through youth and family programs. By targeting young participants through in-schools or enrichment programs' 4-H clubs, nutrition education can be immersed in the school curriculum. This will allow expanding contact hours for nutrition messages and experiential learning opportunities resulting in increased knowledge and adoption of practices that can maintain behavior changes overtime. Teachers can become facilitators, expanding Extension efforts during the school period and long-term impact (six to ten months) can be measured at the end of the school year. Extension professionals can coordinate with school staff to promote a healthier school environment by encouraging more participation in the school lunch program and stronger enforcement of the laws that regulate foods and beverage sales within and near schools [16,17]. In addition, they can integrate parents through different educational methodologies, including face-to-face and electronic means. FCS professionals in PRAES are assigned to all municipalities across the Island and thus can have an impact on many communities, families and individuals. Extension's approach including train-the-trainer and tailored educational materials that address the needs and barriers for the target audience can provide effective means to promote healthy eating by increasing the consumption of dietary fiber through fruits, vegetables and whole grains, which were deficient in this group and will help to combat the childhood obesity epidemic.

This study provided a most needed tailored nutrition education materials for Puerto Rican adolescents. This was the product of the direct opinions and participation of the targeted adolescent audience resulting in a culturally sensitive curriculum that address the barriers that these children confront at home, school and away-from-home environments.

The limitations of the study were not having a control group to further support the effectiveness of the educational materials and that the evaluation period for the Post-II questionnaire could not be extended to six months due to the fact that the timeframe of the project could not match the academic year of the in-schools 4-H clubs.

Conclusion

Culturally sensitive and age appropriate nutrition educational materials promote positive dietary behavior changes to prevent childhood obesity through the consumption of dietary fiber from fruits, vegetables and whole grain cereals. The educational material developed and pilot-tested in this study addressed the needs of a specific Hispanic group. Future studies should expand the applicability of the educational materials to other ethnic groups. This educational strategy can be used within the school curriculum, reaching parents either through face-to-face or online means as well as more collaboration with the school's personnel.

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Conflict of Interest

The authors state there are no conflicts to report.

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